PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Apparatus for Continuously Burning Waste

We, MITSURA TADA, of 2-17-3, Minamicho, Fuchu City, Tokyo, Japan, and TOSHIMARO MIIKE, of 14-40-3, Shimoigusa, Suginami-ku, Tokyo, Japan, both of Japanese nationality, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to an apparatus for burning inflammable waste containing non-inflammable materials in a continuously effective manner.

Food garbage (waste of vegetable and animal foods), miscellaneous waste (paper, fiber, wood, bamboo, plastics, rubber, leather, weeds, fallen leaves, straw, etc.) smeared mud arising from the treatment of dirty water, bark, human or animal feces are all known to contain large amounts of water and moreover, in most cases, such non-inflammable parts as mud, sand, glass or metal waste. The percentage of content of non-inflammable materials is very large especially in food waste and miscellaneous waste.

The present invention provides apparatus for continuously burning waste, comprising a furnace, a flow plate in the lower part of the furnace which flow plate has its upper surface so inclined as to permit descent of non-inflammable waste along the said surface, a wind box below the flow plate and connected to a plurality of air flow orifices in the flow plate, a discharge pipe leading downwardly from the lowest region of the flow plate for receiving non-inflammable waste, an air pipe extending upwardly and having its upper end opening into an upper part of the furnace, the said discharge pipe leading into the air pipe at an intermediate point of the air pipe, means at the lower end of the air pipe for discharging non-inflammable waste, and a feed pipe for pressurised air which pipe is connected to the air pipe between the said means and the junction of the air pipe with the discharge pipe.

The invention will be further described, by way of example, with reference to the accompanying drawings wherein;

Fig. 1 is a vertical section of apparatus according to the present invention;

Fig. 2 is a sectional plan view of the same apparatus, taken along the line A—A of Fig. 1;

Fig. 3 is a sectional view in part of a modified apparatus;

Fig. 4 is a sectional plan view of the apparatus of Fig. 3;

Fig. 5 is a sectional view in part of another modification of the apparatus;

Fig. 6 is a sectional plan view of the apparatus of Fig. 5; and

Fig. 7 is a sectional view in part of another modification of the apparatus.

Fig. 1 shows a furnace which has a body 1 and a first inclined flow plate 3 with many orifices 2 disposed in the lower part of the interior of the furnace body 1. Beneath the lower surface of the inclined flow plate 3 is a first wind box 4 connected to said orifices 2. An outlet 5 for non-inflammable materials is disposed at the lower end portion of said inclined flow plate 3. Over the upper end of said outlet 5 is provided a second wind box 6 spaced above said outlet so as to cover the outlet 5, and a second flow plate 7 is disposed on the upper surface of said wind box 6. Air pipes 8 serve not only to support the second wind box 6 on the flow plate 3 but also to connect the second wind box 6 to the first wind box 4. Another air pipe 9 extends upwardly from a level below the outlet 5, and the upper end 10 of the air pipe 9 opens in the upper part of the furnace 1. A discharge pipe 11 has its upper end connected to the outlet 5 and its lower end connected to the middle portion of the air pipe 9. An exhaust pipe 12 for non-inflammable materials is

[*Price*

disposed at the bottom of air pipe 9 and in this embodiment it is provided with a damper 13 near its lower end which is further equipped with a closure member 14. The members 13 and 14 may be of usual construction for practical use. A pressurized feed pipe 15 for said air pipe 9 is connected between a supply source of pressurized air (not shown in the drawing) and an expanded portion 9_1 of the air pipe 9. A pressurized air feed pipe 16 leads to the first wind box 4 and is connected to either the same supply source as said feed pipe 15 or another feed pipe. A damper 17 is inserted in the discharge pipe 11. An aeration device 18 of usual construction is disposed at a suitable position of said discharge pipe 11. Moreover there are provided an inlet 19 for a fluidized bed medium, a screw feeder 20 disposed at said inlet, a heavy oil burner 21, a chimney 22, a waste inlet 23, a rotary feeder 24; a bed 25 of fluidized medium is formed on the inclined flow plate 3. Usually sand is used as a fluidized bed medium but chamotte particles or residual particles of roasted ores may also be used, insofar as they are non-inflammable granular solids which cannot become soft at temperatures used in burning waste. These solids are preferably of a larger specific gravity than the inflammable materials of the waste and of a smaller specific gravity than the non-inflammable waste, and are between the limits of mesh, 0.05—1.5 mm. The angle of inclination of said first flow plate 3 is preferably 10°—15°.

In the case of a furnace of a relatively small diameter, it is possible to use a one-side inclined flow plate 2 as shown in Fig. 3. In this case, the second flow plate 7 will be arranged in position as shown in Figs. 3 and 4. In the case of a furnace of a relatively large diameter, the first flow plate 3 will be arranged better in the form of chevron in section as shown in Fig. 5. This has the advantage that the discharge pipe 11 can be shorter than in a system in which the outlet 5 is centrally disposed as in Figure 1.

Instead of providing the second wind box 6 and the second flow plate 7, the orifices 2 may be made larger in size toward the lower region of the inclined surface as shown in Fig. 7, or they may be increased in number, thereby enabling the whole fluidized bed to flow in a uniformly fluidized form.

The present apparatus operates in the following manner.

First of all, a suitable amount of fluidized bed medium with the addition of fuel, e.g. pulverized coal, is fed from the inlet 19, the heavy oil burner 21 is ignited and air is supplied to the wind boxes 4 and 6 from the air supply source (not shown in the drawing) through the feed pipe 16. The air thus fed is ejected from the orifices of both flow plates 3 and 7 to reach said pulverized coal, thereby fluidizing said fluidized bed medium on the flow-plate. The pulverized coal is ignited by means of the heavy oil burner 21 and burnt satisfactorily. When the temperature of the fluidized bed medium has risen until its fluidization progresses sufficiently, waste is thrown into the furnace through the inlet 23, and ignited and burnt while fluidised by means of the fluidized bed medium. When the temperature of the furnace reaches around 750°C, the heavy oil burner is extinguished. When using sand of 0.2—0.8 mm mesh as a fluidized bed medium, it is necessary to feed air into the furnace so that its velocity in the fluidized bed is 40—60 cm/sec to produce perfect fluidization of the fluidized bed medium and to maintain the temperature of the furnace at 950°C or thereabouts. If the content of water in the wastes is less than 40%, the temperature of the furnace tends to rise higher than necessary. Then a cooling medium, e.g. water is poured into the fluidized bed to maintain the furnace at an appropriate temperature.

During burning, food waste and miscellaneous waste float in the fluidized bed medium and are burnt well because they are of a smaller specific gravity than the fluidized medium. On the other hand, non-inflammable materials such as mire, sand, glass or metals, stone, glass, ceramics, empty metal cans, etc. sink down beath the fluidized medium because they are of a larger specific gravity and size than the fluidized medium, and move down along the inclined surface of the flow plates 3 and 7, and together with part of the fluidized bed medium, flow down into the air pipe 9 from the discharge outlet 5. The fluidized bed medium and said non-inflammable materials in said air pipe 9 are separated by blowing air at a flow rate larger than the terminal velocity of said fluidized bed medium, flowing upwardly through the air pipe 9 so that the fluidized bed medium is lifted up in the air pipe 9 and returned into the furnace through opening 10; the non-inflammable materials thus separated move down the air pipe 9 and are discharged finally from the exhaust pipe 12.

The above-mentioned separating procedure with blowing air is controlled by adjusting the opening of the damper 17 and the amount of air from the feed pipe 15. The aeration device 18 prevents the non-inflammable materials from staying in the exhaust pipe 11. There is a difference in pressure between the outlet 5 and the opening 10 with the result that said air circulation can be kept going to a satisfactory degree.

The discharge of the non-inflammable materials from the exhaust pipe 11 is preferably carried out as follows. It is necessary to open the damper 13, to begin with, so that the non-inflammable materials are caused to drop onto the member 14, and when they have collected in a suitable amount, the

damper 13 is closed after which member 14 is opened to allow the non-inflammable materials to be discharged from the pipe. Subsequently, said member 14 is closed and the damper 13 is re-opened. This operation is repeated as often as necessary. A rotary air-tight exhaust device may be used instead of said damper 13 and member 14.

The fine ashes arising from the burning operation are carried away by means of the air and combustion product flow and discharged outwardly of the furnace body from the chimney 22 for collection by means of a separator and collector e.g. a cyclone-type collector (not shown in the drawing).

If the waste for treatment is dust and dirt, the miscellaneous waste and food waste thereof may contain about 20% of non-inflammable materials in most cases and about 50% of such non-inflammable materials are of extremely large in size. It is nevertheless very easy to discharge such non-inflammable materials in an extremely effective manner from our furnace. Consequently, it is possible to burn the waste very effectively without first separating large-size mire and sand, glass, ceramics, metals from the waste. Furthermore, it is possible to burn inflammable materials such as mud containing organic material, feces, bark, etc. also very effectively and at the same time, to discharge non-inflammable materials contained therein in a continuous manner.

WHAT WE CLAIM IS:—

1. Apparatus for continuously burning waste, comprising a furnace, a flow plate in the lower part of the furnace which flow plate has its upper surface so inclined as to permit descent of non-inflammable waste along the said surface, a wind box below the flow plate and connected to a plurality of air flow orifices in the flow plate, a discharge pipe leading downwardly from the lowest region of the flow plate for receiving non-inflammable waste, an air pipe extending upwardly and having its upper end opening into an upper part of the furnace, the said discharge pipe leading into the air pipe at an intermediate point of the air pipe, means at the lower end of the air pipe for discharging non-inflammable waste, and a feed pipe for pressurised air which pipe is connected to the air pipe between the said means and the junction of the air pipe with the discharge pipe.

2. Apparatus as claimed in claim 1 having a further flow plate extending above the inlet of the discharge pipe and also having an inclined upper surface and orifices therein for air flow.

3. Apparatus as claimed in claim 2 wherein the further flow plate contains a further wind box in communication with the first-mentioned wind box.

4. Apparatus as claimed in claim 1, 2 or 3 having a damper in the discharge pipe.

5. Apparatus as claimed in any of claims 1 to 4 in which the said means comprises a closure member at the lower end of the air pipe and a damper in the air pipe between the closure member and the junction of the air pipe with the feed pipe.

6. Apparatus for continuously burning waste, substantially as herein described and shown in Figures 1 and 2, figures 3 and 4, figures 5 and 6 or Figure 7 of the accompanying drawings.

MARKS & CLERK,
Chartered Patent Agents,
Agents for the Applicant(s).

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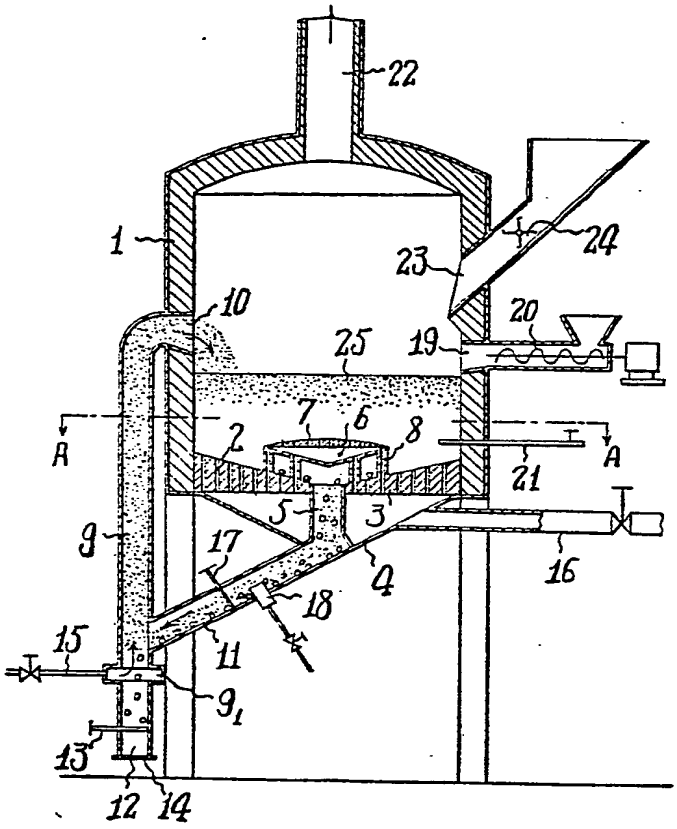
1166675 COMPLETE SPECIFICATION
2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 1

Fig 1



1166675 COMPLETE SPECIFICATION

2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 2

Fig 5

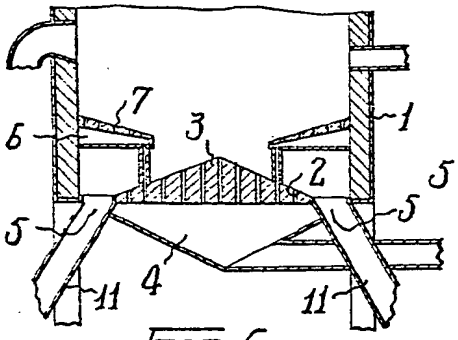


Fig 2

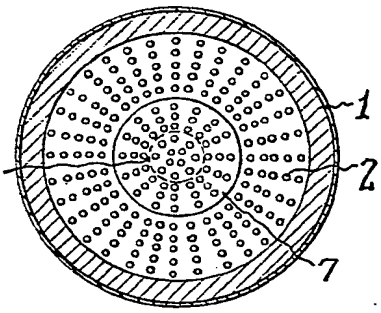


Fig 6

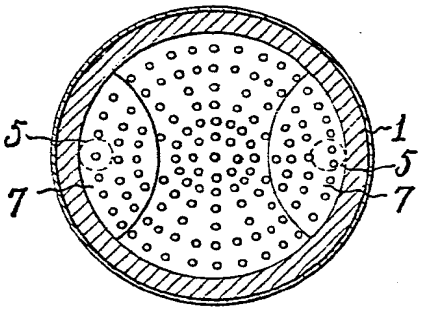


Fig 3

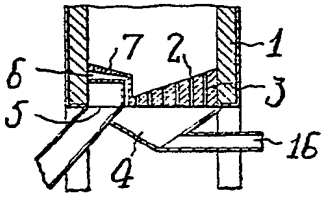


Fig 4

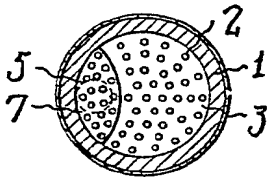


Fig 7